A NEW FOSSIL WOOD RESEMBLING THE GENUS *PARINARIUM* OF THE FAMILY ROSACEAE FROM THE TERTIARY OF SOUTH INDIA

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ABSTRACT

A fossil wood collected from near the villages Murattandichavadi and Kasipalayam, about 8-10 km. W.N.W. of Pondicherry is described. In all the anatomical characters it resembles the wood of the genus *Parinarium* of the Rosaceae. It is placed under the genus *Parinarioxylon* Pfeiffer & Van Heurn., and named as *Parinarioxylon cuddalorense* sp. nov.

INTRODUCTION

OUT of a large number of petrified woods collected in 1962 and 1963 from an area which lies between Murattandichavadi, Kasipalayam and Tiruchitambalam near Pondicherry, South Arcot district, Madras, only a few resembling *Mesua, Calophyllum, Mangifera, Gluta-Melanorrhoea, Millettia* and *Sonneratia* have been described so far (LAKHANPAL & AWASTHI, 1964, 1965; AWASTHI 1966, 1967, 1968). Besides, the earlier workers had described a large number of angiospermous and gymnospermous woods from the same area as already mentioned by Lakhanpal and Awasthi (*l.c.*) and Awasthi (*l.c.*). Further investigation of the material has shown the presence of some more new forms. One of them shows affinities with the modern genus *Parinarium* of the Rosaceae, and is described below.

DESCRIPTION

Family — ROSACEAE

Genus — *Parinarioxylon* Pfeiffer & Van Heurn, 1928

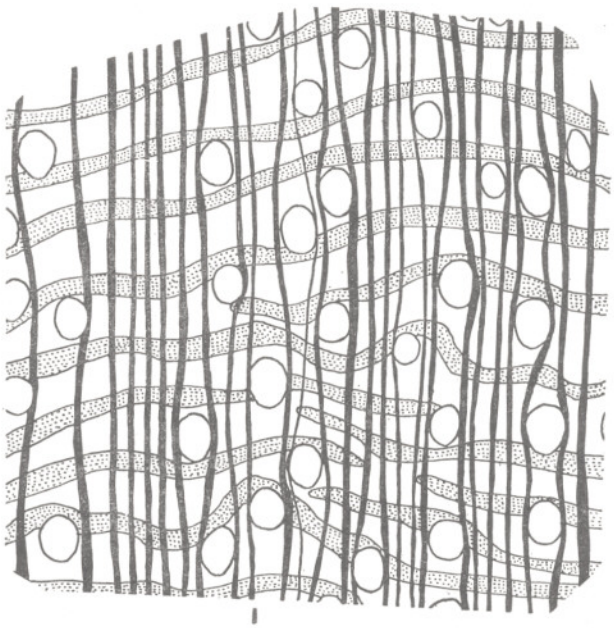
Parinarioxylon cuddalorense sp. nov.

Pl. 1, Figs 1, 2, 4, 6; Text-figs. 1-4

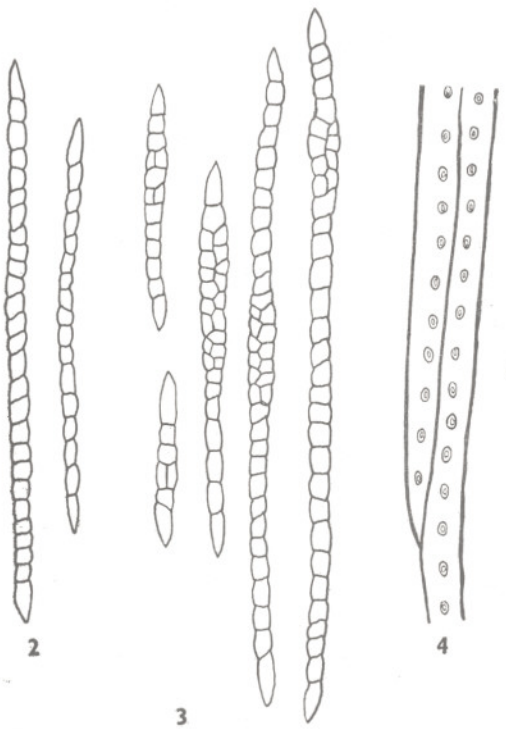
The fossil is represented by two pieces of silicified wood. The bigger one is about 36 cm. in length and 6 cm. in diameter. The preservation is fairly good.

Topography — Wood diffuse-porous (PL. 1, FIG. 1). *Growth rings* not seen. *Vessels* not visible to the naked eye, visible with the help of a hand lens in cross-section as small pinholes, small to medium in size, exclusively solitary (PL. 1, FIGS. 1, 4; TEXT-FIG. 1), showing tendency toward radial alignment, about 4-14 vessels per sq. mm., tylosed. *Parenchyma* apotracheal, in fine tangential lines or bands, each 1-3 (mostly 2) cells wide (PL. 1, FIGS. 1, 4; TEXT-FIG. 1), wavy, continuous as well as broken, interrupted by xylem rays; 6-10 bands per mm. *Xylem rays* fine, uniseriate, occasionally biseriate due to pairing of procumbent cells through the median thickened portion (PL. 1, FIG. 2; TEXT-FIGS. 2, 3); ray tissue heterogeneous, rays heterocellular, consisting of procumbent cells and 1-2 marginal rows of upright cells at one or both the ends; rays 2-40 (mostly 10-30) cells and 70-1000 μ or sometimes more in height, 15-24 per mm. *Fibres* (Fibre-tracheid) aligned in radial rows between the two consecutive xylem rays (PL. 1, FIG. 4).

Elements — Vessels circular to oval in cross-section (PL. 1, FIG. 2), t.d. 90-150 μ, r.d. 90-195 μ, thick-walled, walls 6-16 μ in thickness; vessel-members with truncated or tailed ends; perforations simple; pits leading to contiguous fibre-tracheids small, about 4 μ in diameter, circular, with small circular or slit-like apertures (PL. 1, FIG. 6). *Parenchyma cells* circular to oval along the tangential plane, t.d. 16-20 μ, r.d. 16-28 μ, vertical length 40-120 μ, walls 2-4 μ in thickness; infiltration dark. Upright *Ray cells* 35-52 μ in tangential height, 20-44 μ in radial length; procumbent cells 16-24 μ in tangential height, crystals occasionally present. *Fibre-tracheids* angular (mostly hexagonal), 8-24 μ in diameter, nonseptate, thick-walled, with narrow lumen, wall 4-8 μ thick, pits occasionally seen, frequent in the wider cells bordering the vessels, arranged in vertical rows, small, with slit-like apertures (TEXT-FIG. 4).



TEXT-FIG. 1 — Cross-section of the fossil showing shape, size and distribution of vessels and parenchyma. × 45.



TEXT-FIG. 2-4 — Uniseriate xylem rays. × 100. 3. Biseriate xylem rays. × 100. 4. Fibres with bordered pits. × 300.

AFFINITIES

Comparison with the modern woods — The important anatomical features of the present fossil wood are: (1) vessels exclusively solitary and occasionally aligned in radial lines; (2) parenchyma apotracheal, in 1-3 seriate concentric tangential bands; (3) xylem rays fine, 1-2 (mostly 1) seriate, heterogeneous and (4) fibre-tracheids non-septate, thick-walled with bordered pits. Taking into consideration all these important characters the fossil wood shows affinities with the woods of Chrysobalanoideae of the family Rosaceae. However, its resemblance in some features has also been seen with the woods of Guttiferae (*Mesua* and *Calophyllum*) and Casuarinaceae (*Casuarina*).

Mesua resembles the present fossil wood in several features. In both, the vessels are exclusively solitary and more or less irregularly distributed, parenchyma apotracheal in concentric tangential bands and fibres thick-walled. But the present fossil wood differs from *Mesua* in several other important anatomical features, such as in having comparatively thinner apotracheal parenchyma bands, absence of vasicentric tracheids and presence of fibre-tracheids.

Moreover, in the present fossil wood the vessels are not so much distinctly arranged in groups along the radial line as in *Mesua*. Similarly, *Calophyllum* resembling the present fossil wood in a number of features, differs in possession of larger vessels, abundant vasicentric tracheids, usually broad apotracheal parenchyma bands and the nature of the fibres.

The wood of *Casuarina* also resembles the present fossil in several features except ray characters, i.e. in *C. equisetifolia* the xylem rays are 1-4 seriate (PEARSON & BROWN, 1932). Besides, some of the woods of *Casuarina* possess aggregate rays (METCALFE & CHALK, 1950).

The woods of the sub-family Chrysobalanoideae are uniform in their anatomical features. Metcalfe and Chalk (1950, pp. 552-553, FIGS. A-D) have given the general anatomy of the genera *Acioa, Angelesia, Chrysobalanus, Couepia, Grangeria, Hirtella, Licania, Parastemon* and *Parinari* (*Parinarium*). From the general description of these woods it is evident that the present fossil wood resembles the genus *Parinarium* Juss. (*Parinari* Aubl.). The other genera differ from it in some significant features. According to Metcalfe and Chalk (*l.c.*) in *Chrysobalanus, Couepia, Grangeria, Hirtella* and *Licania* the xylem rays are exclusively uniseriate while in *Parinarium* they are predominantly uniseriate but with some biseriate. In the present fossil wood too the xylem rays are predominantly uniseriate and occasionally biseriate. Thus in ray characters it is different from the above genera except *Parinarium*. Genus *Couepia* and some species of *Licanaia* further differ in having of thinwalled fibres. In *Angelesia* the tyloses are sclerosed. The last genus, *Parastemon* differs from the present fossil in having homogeneous xylem rays and uniseriate lines of apotracheal parenchyma.

Among the modern species of *Parinarium* (*Parinari*) the present fossil wood was compared with the thin-sections of *Parinarium anamense* Hance, *P. campestris* Aubl., *P. corymbosum* Miq., *P. excelsum* Sab., *P. griffithianum* Benth., *P. holstii* Engl., *P. pachyphyllum* Rusby, *P. pariles* Macb., *P. travancoricum* Bedd. and *Parinarium* sp. F.M.S. Including some of the above species the fossil wood was also compared with the description and figures of *Parinari tenuifolia* A. Chev., *P. kerstingii* Engl., *P. robusta* Oliv. (NORMAND 1960, pp. 92-95, PL. 22-23), *P. excelsa* Sab. (NORMAND, *l.c.* pp. 92-95, PL. 22; HENDERSON, 1953, p. 53, FIG. 322), *P. campestris* Aubl. (KRIBS, 1959, pp. 135-136, FIG. 451), *Parinarium griffithianum* Benth., *P. sumatranum* Benth. (MOLL & JANSSONIUS; 1914, pp. 222-230, FIG. 171), *Parinari corymbosum* (Blume) Mignel (KANEHIRA, 1924, p. 30; DESCH, 1954, pp. 482-483, TABLE 96; REYES, 1938, pp. 108-109, PL. 14, FIG. 3; SCHNEIDER, 1916, p. 114, PL. 11, FIG. 13), *P. lauritum* A. Gray (SCHNEIDER, 1916, p. 114), *P. costatum* Bl., *P. asperulum* Miq., *P. glaberrinum* Hassk. Syn., *P. scabrum* Hassk., *P. nitidum* Hook. f., *P. oblongifolium* Hook. f., *P. rubiginosum* Ridl. (DESCH, 1934, pp. 480-483, TABLE 96) and *P. mobola* Oliv. (METCALFE & CHALK, 1950, p. 552, FIG. 121D). From the detailed comparative study it has been found that the present fossil wood shows nearest resemblance with the wood structure of *Parinarium corymbosum* (Blume) Mignel. in all the anatomical details except the vessel dimension, i.e. the size of the vessels in *P. corymbosum* is large with lesser frequency as compared to the present fossil wood. In general the other species differ from the present fossil wood in the size and frequency of the vessels and thickness of the parenchyma bands.

Comparison with the fossil species — So far only a few fossil woods of the family Rosaceae are known, viz. *Pruninium gummosum* Platen (1908) from the Miocene of Yellowstone National Park (Amethyst Mt.), *Prunus* sp. Szafer (1914) from the Pleistocene of Poland, *Pomoxylon* sp. Hofmann (1944) from the Miocene of Prambachkirchen, Germany, *Rosaceoxylon spiraeoides* Shilkina (1958) from the Tertiary of Goderdzy Pass, Russia and *Parinarioxylon itersonii* Pfeiffer & Van Heurn (1928) from the Tertiary of Java (Boland), *Maloidoxylon castellanense* Grambast (1966) from the Tertiary of Castellane (Basses-Alpes), France. Of these the only comparable one is *Parinarioxylon itersonii*. Both the woods, i.e., the present fossil wood and *Parinarioxylon itersonii* resemble each other in a number of features which are common in both, such as exclusively solitary vessels, apotracheal parenchyma bands, 1-2 seriate heterogeneous xylem rays and thick-walled fibres. However, it differs from *P. itersonii* in some other features. In the present fossil wood the vessels are small to medium

and their frequency is 4-14 per sq. mm., parenchyma bands are 1-3 (mostly 2) seriate and fibres are with bordered pits; whereas in *P. itersonii* the vessels are large to very large and their frequency is less, i.e. 1-2 vessels per sq. mm. and the apotracheal parenchyma is represented by fine uniseriate lines.

The present fossil wood is placed under the genus *Parinarioxylon* Pfeiffer & Van Heurn and named as *Parinarioxylon cuddalorense* sp. nov., the specific name is after Cuddalore Series.

PRESENT DISTRIBUTION OF *PARINARIUM*

The genus *Parinarium* Juss. (*Parinari* Aubl.) consists of 60 species (Willis, 1966, p. 834) mostly shrubs or small trees though a few attain rather large proportions, very widely distributed in the tropical and subtropical regions of the southern hemisphere (Record & Hess, 1949). In India only two species are found, viz., *Parinarium indicum* Bedd. and *P. travancoricum* Bedd., both grow in South India. *Parinarium corymbosum* with which the fossil wood resembles most is found only in the Malayan region.

Diagnosis—*Wood* diffuse-porous. *Growth-rings* absent. *Vessels* small to medium, t.d. 90-150 μ, r.d. 90-195 μ, exclusively solitary, showing a tendency towards radial alignment, 4-14 vessels per sq. mm.; perforations simple; pits leading to contiguous fibres-tracheid numerous, small, with circular or slit-like apertures. *Parenchyma* apotracheal, 1-3 seriate, in concentric tangential bands, wavy, 6-10 bands per mm. *Xylem rays* fine, uniseriate, occasionally biseriate due to pairing of procumbent cells through the median portion; rays tissue heterogeneous; rays heterocellular, consisting of procumbent cells and 1-2 marginal rows of upright cells at one or both the ends, 2-40 (mostly 10-30) cells in height; 14-24 rays per mm.; crystals occasionally present. *Fibres* nonseptate, thick-walled, 4-8 μ in thickness, pits bordered, small to minute, with circular or slit-like apertures.

Holotype — B.S.I.P. Museum No. 33703.

Locality — Between Murattandichavadi and Kasipalayam near Pondicherry.

ACKNOWLEDGEMENTS

The author is deeply indebted to Dr. R. N. Lakhanpal for his valuable guidance. He is also thankful to Shri K. Ramesh Rao, Officer-in-Charge, Wood Anatomy Branch, Forest Research Institute, Dehra Dun, for facilities to consult the authentic slides of modern woods.

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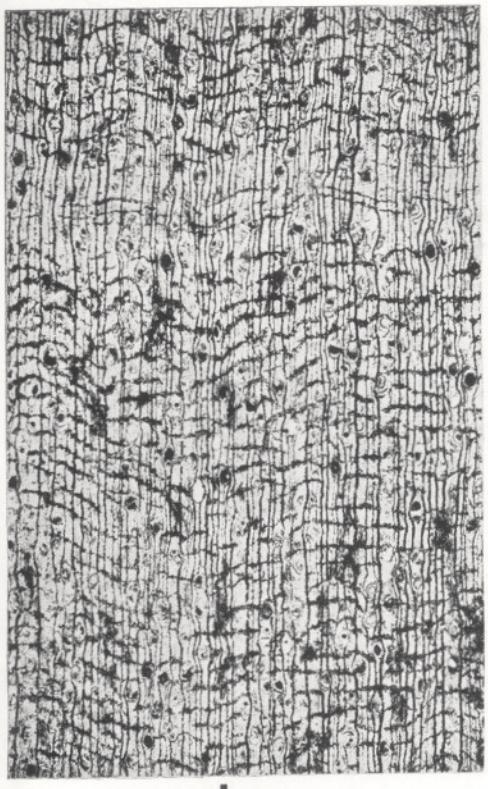

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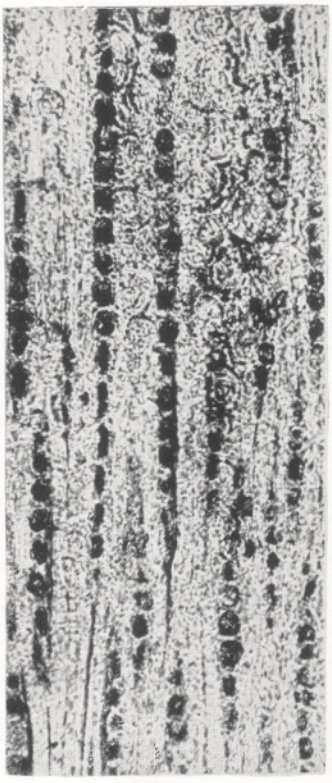

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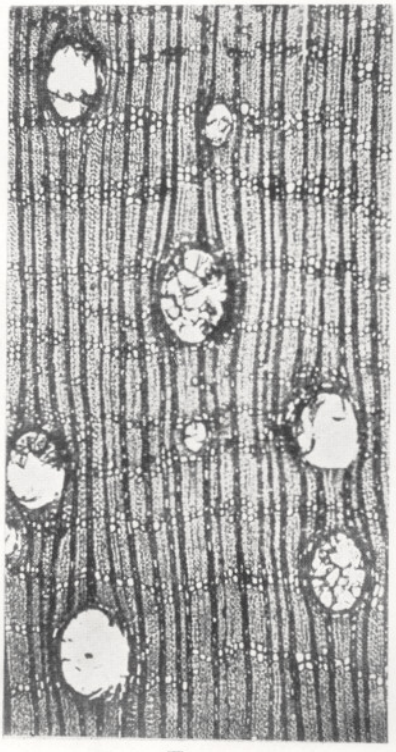

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EXPLANATION OF PLATE 1

1. *Parinarioxylon cuddalorense* sp. nov. — Cross-section of the fossil wood showing nature and distribution of vessels and parenchyma. × 15.

2. *Parinarioxylon cuddalorense* sp. nov.— Tangential longitudinal section of the fossil showing xylem rays. × 135.

3. *Parinarium corymbosum* — Tangential longitudinal section showing similar xylem rays. × 135.

4. *Parinarioxylon cuddalorense* sp. nov.— Cross-section magnified to show the shape, size and distribution of vessels and parenchyma bands. × 60.

5. *Parinarium corymbosum* — Cross-section showing similar type and distribution of vessels and parenchyma. × 60.

6. *Parinarioxylon cuddalorense* sp. nov.— A portion of a vessel in tangential longitudinal section showing pits. × 500.